Using the Brute Force Method to Push Back Flood Waters as a Result of Sea Level Rise in Miami Beach

Presentation to the South Florida Hydrologic Society

MIAMI BEACH

December 3, 2014


PUMPED OUT!
SCOTT ROBINS AS
PUMP MAN
THE OCEAN AS
KING TIDE
PM
COMING SOON
TO A STREET NEAR YOU

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Flooding in Miami Beach – West Avenue Looking South

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Source: South Florida Hydrologic Society Website (http://sfhs.fiu.edu/)

Time lapse photo set taken November 14, 2012 from 7:00 to 10:30AM

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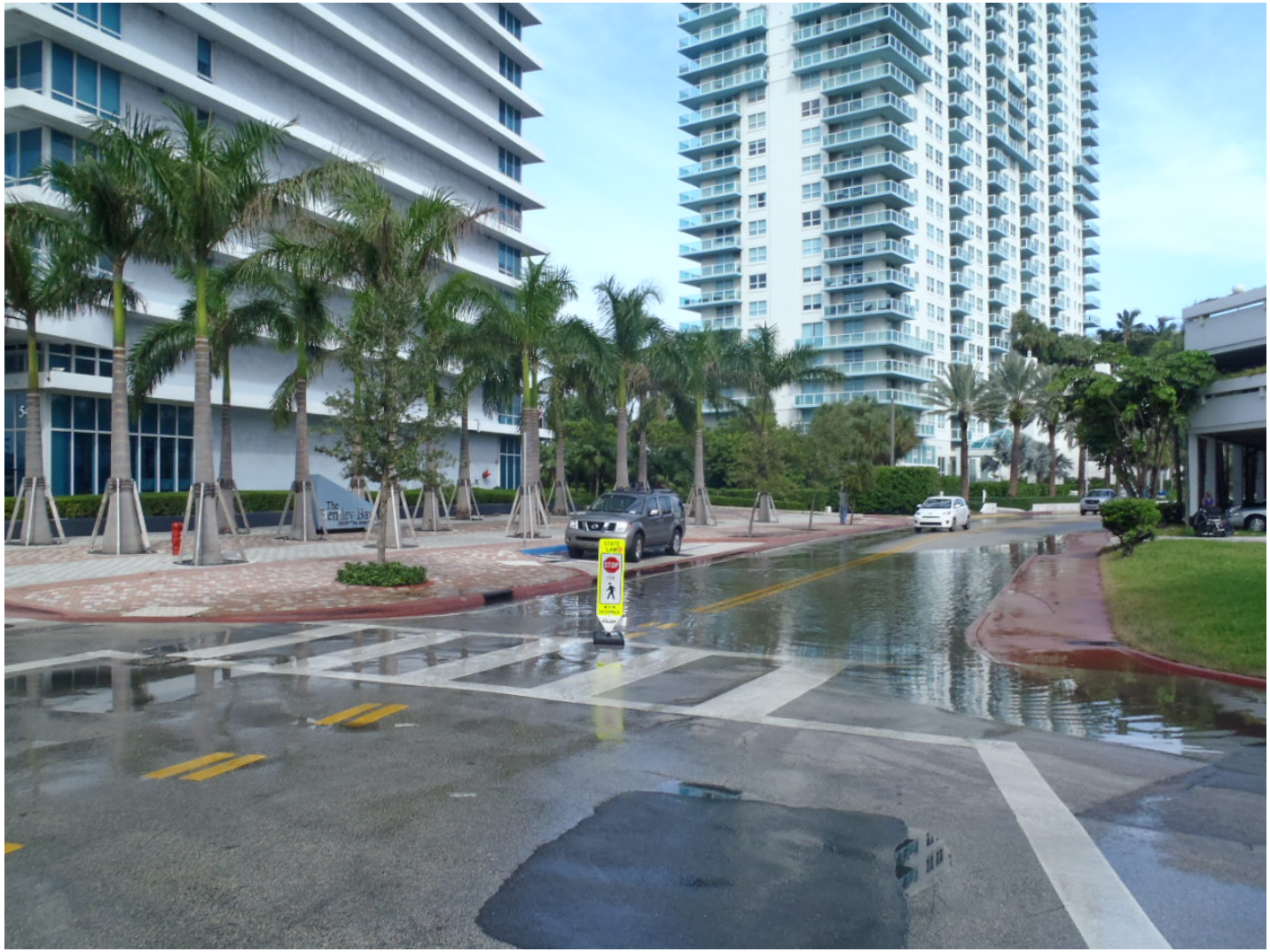
6th Street and West Ave.



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14th Street and West Ave.

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King Tide - October 7, 2010

8th Street and Alton Road

8th Street and West Avenue

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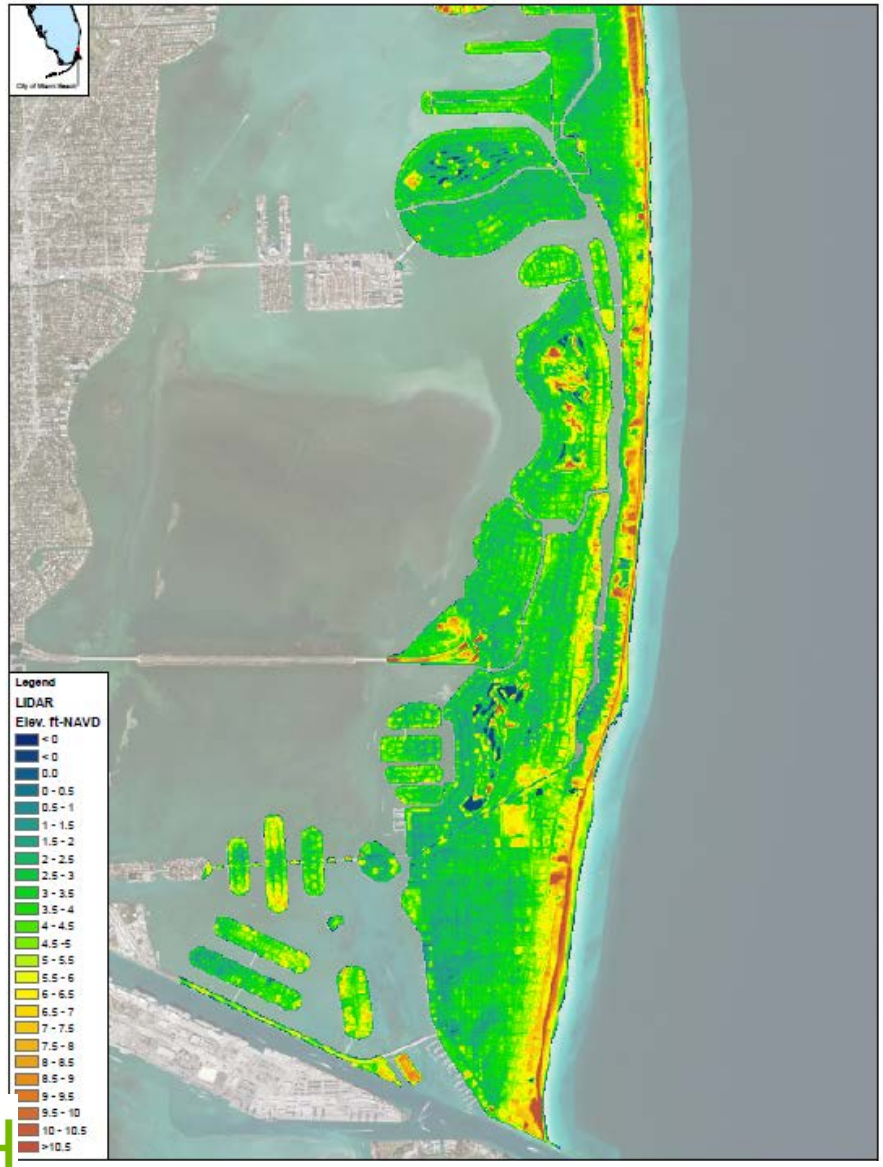
City of Miami Beach – LiDAR Topography



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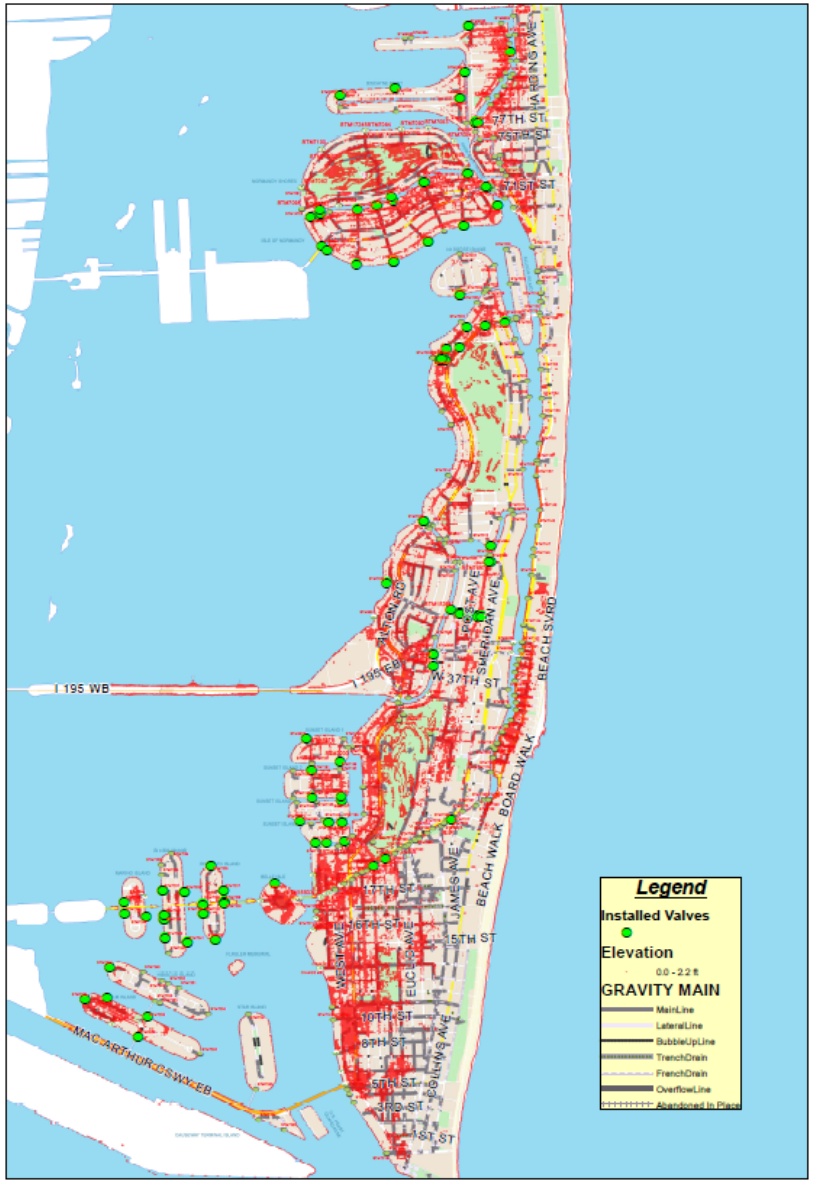
City of Miami Beach – Elevations Below 2.2-ft NAVD



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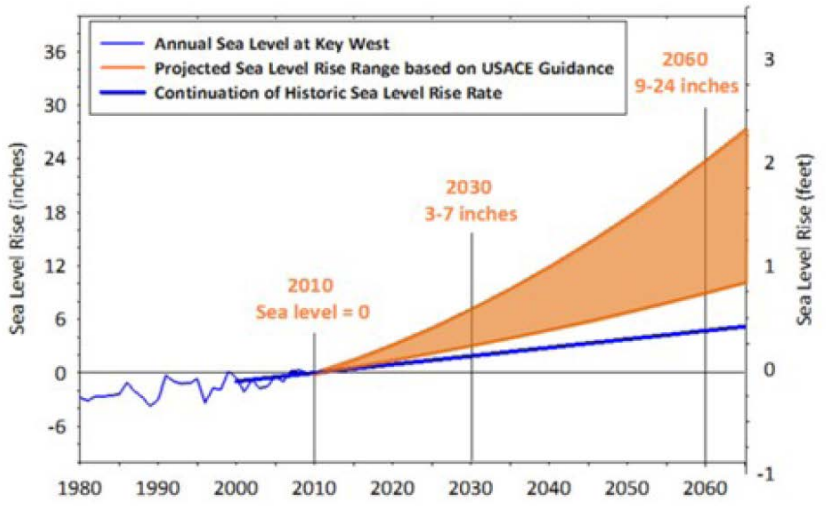
Sea Level Rise Facts

- Over the last 100 years, sea levels have risen 7 inches
- Prediction of sea level rise is an uncertainty
- Sea level rise will occur, the uncertainty is how much and how soon
- Projections:
  - 2039 – 7 inches
  - 2064 – 18 to 24 inches
  - 2114 – 36 to 60 inches



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Affects of sea level rise

- Tidal Flooding – Biscayne Bay backing up through City outfalls, flooding streets, commercial & residential areas
- Groundwater rise – higher salinity groundwater will impact landscaping
- Change in shoreline will affect
  - public use of beaches
  - natural vegetation along Biscayne Bay

17th Street Looking West During King Tide

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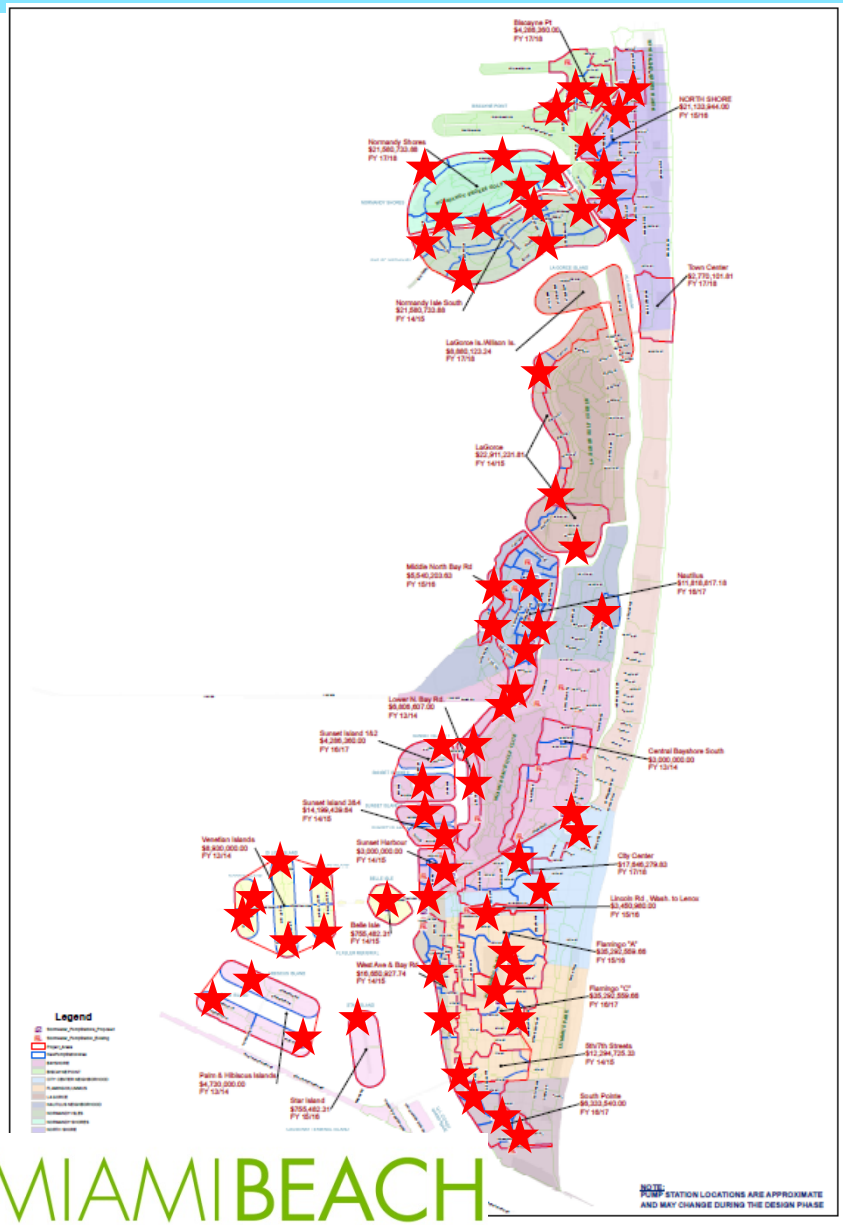
City of Miami Beach – 5-Yr Stormwater Master Plan (Updated)



- City's goal is not to have one drop of salt water in the City's ROW
- Short Term Engineering Activities:
  - Install check valves in areas of the City that have severe flooding
  - As sea level rise continues, additional check valves will be required over the next 0-5 years
  - Find opportunities to replace several outfalls with just one pump station outfall
  - Seawall Improvements
- Use 25, 50 and 100 year planning horizons

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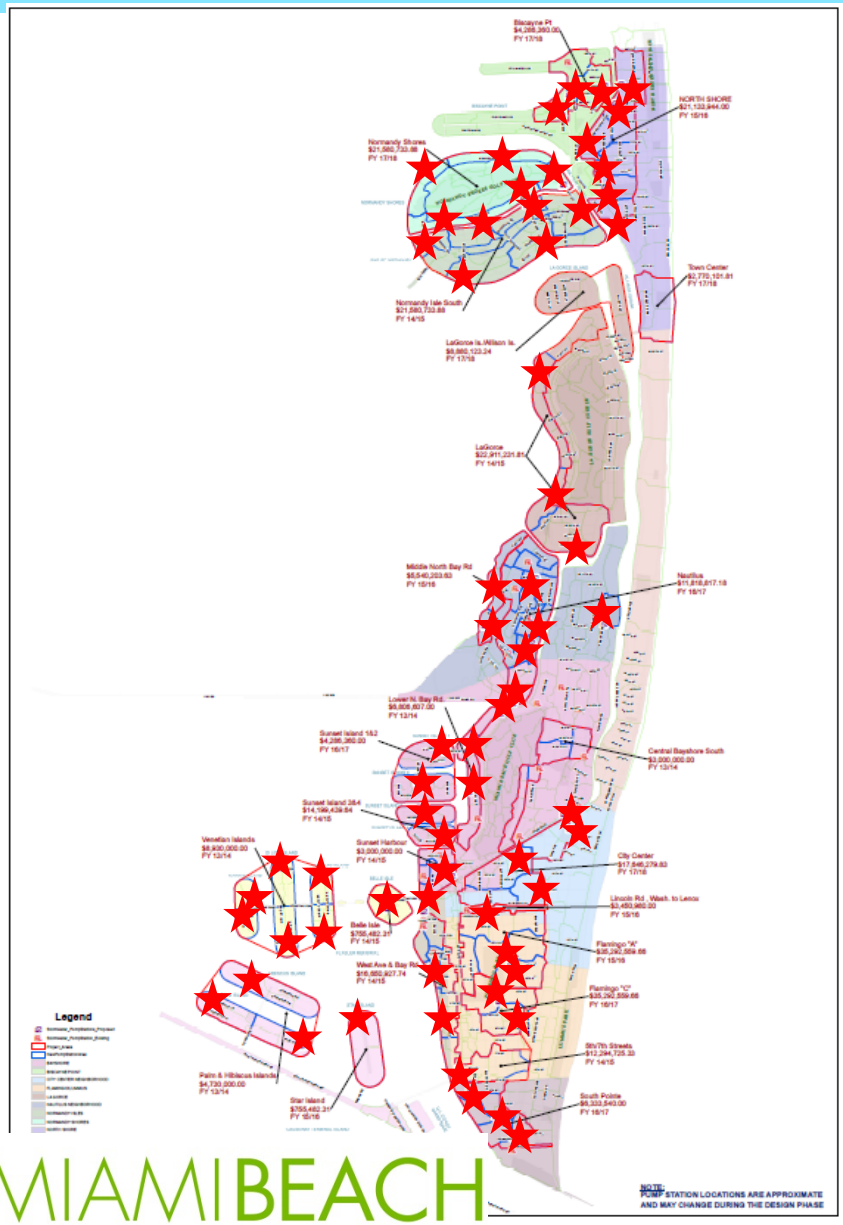
City of Miami Beach – 5-Yr Stormwater Master Plan (Updated)



- Obstructions:
  - There is room for Improvement in the coordination of common goals objectives within the City processes for procurement, Human Resources, Public Works, Capital Improvement Program
  - City's departments are under-staffed to handle fast pace of five year program to build 60+ stormwater pump stations
  - Funding of program will cost $300 million over the next 5 years
  - "Not-in-my-backyard"
- Proactive Management to address obstructions:
  - City recognitions of the issues and assignment of responsibility
    - Blue Ribbon Committee
      - Leadership from the Community
    - City Flood Mitigation Committee

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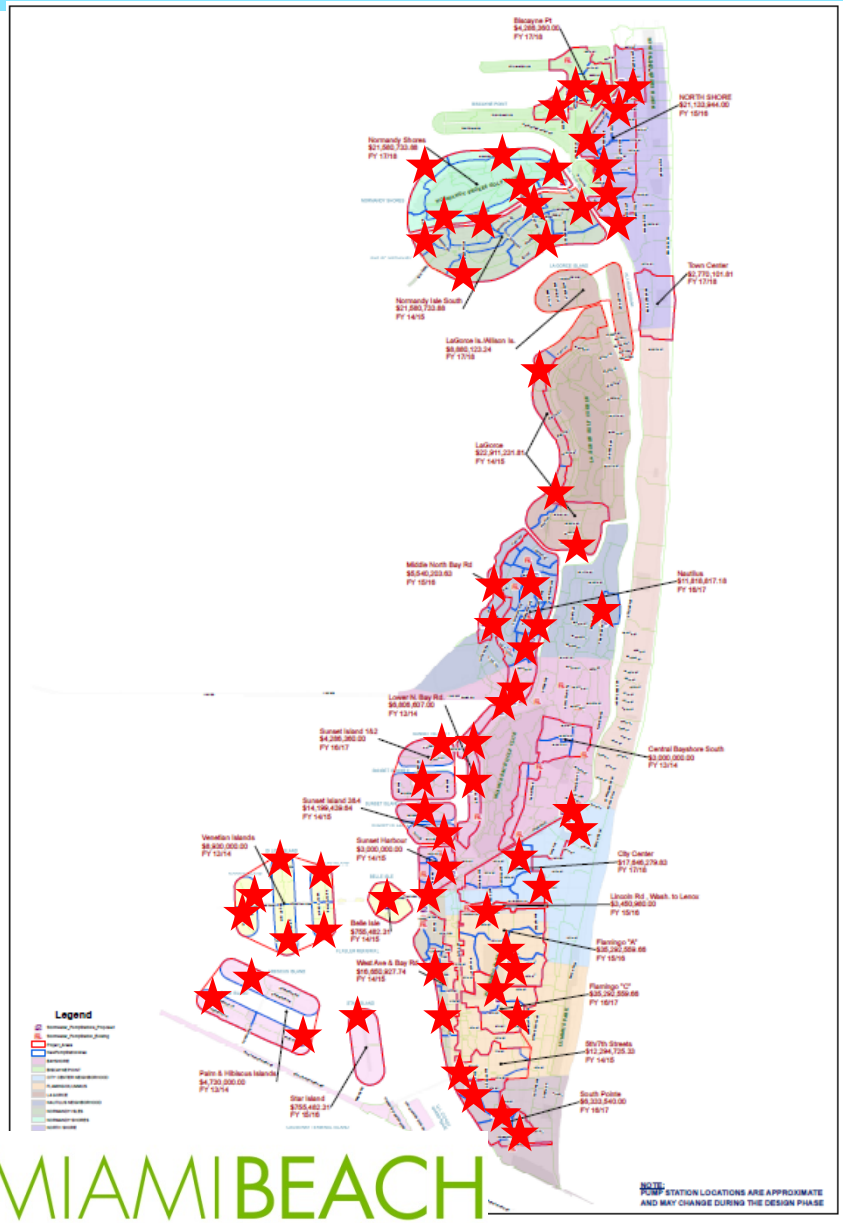
City of Miami Beach – 5-Yr Stormwater Master Plan (Updated)



- Long(er) Term Options:
  - Evaluate options to better manage groundwater resources
  - Stormwater fees
  - Alternative stormwater management methodologies
    - Deep well injection in FAS
    - Groundwater storage / Salinity barriers
  - Establish Minimum Elevations for:
    - Roadways
    - Sidewalks
    - Inlet Grates, and
    - Sea Wall Elevations

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Seawall Construction

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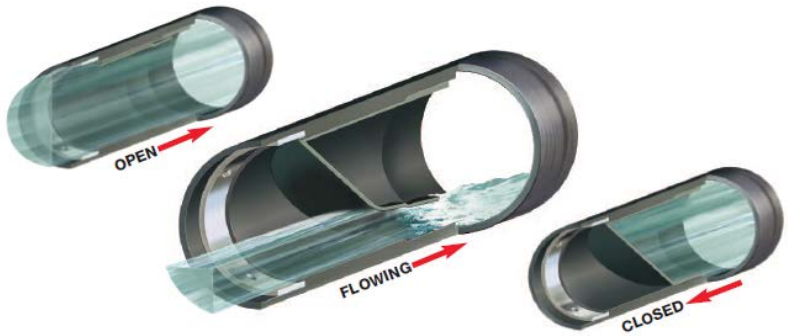
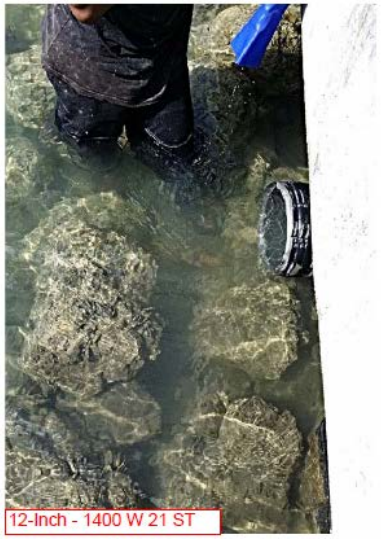
Check Valves

- First, plug the holes with check valves:
  - Install on all outfall pipes
  - Subject to malfunctions so require regular maintenance
  - They will make it harder to drain rainfall
  - Not a solution but a temporary fix




48-Inch - 800 West Ave


10-Inch - 63 ST and Alton Rd


12-Inch - 1400 W 21 ST


12-Inch - 2501 Lake Ave

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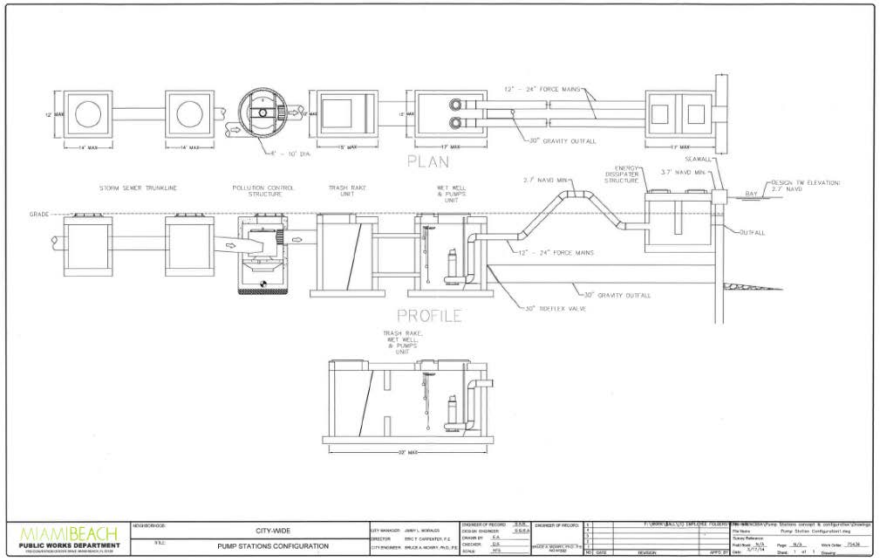
Pump Stations

- New / additional Stormwater pump stations:
  - Limit tidal flooding
  - Designed to provide a set level of service based on boundary condition:
    - 50-Year Sea Level Rise (+1.5-ft)
    - King Tide (+1.2-ft)
  - Will include pump discharge and gravity bypass discharge



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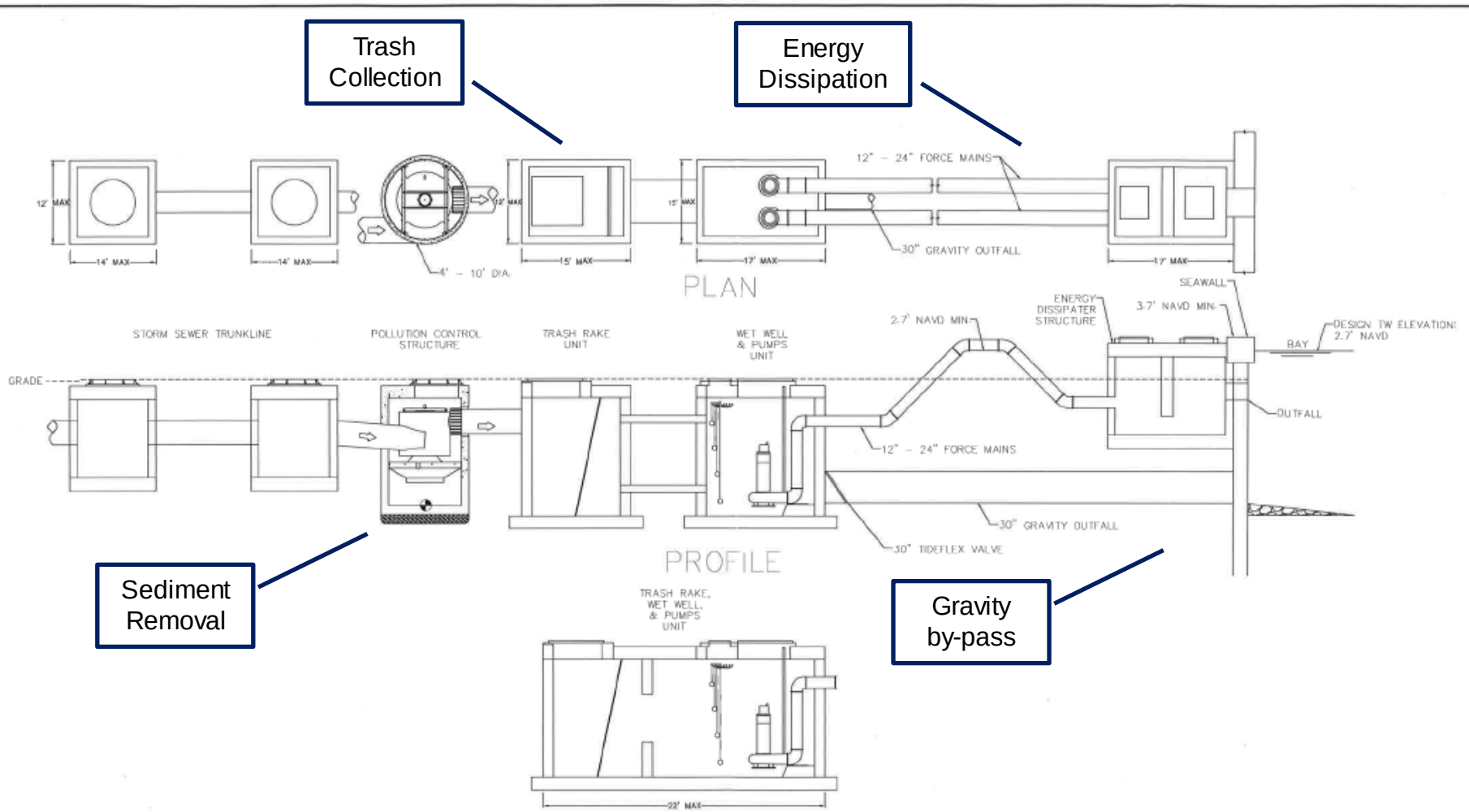
Pump Stations



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PUBLIC WORKS DEPARTMENT

NEIGHBORHOOD: CITY-WIDE

TITLE: PUMP STATIONS CONFIGURATION

CITY MANAGER: JIMMY L. MORALES
DIRECTOR: ERIC T. CARPENTER, P.E.
CITY ENGINEER: BRUCE A. MOWRY, PH.D., P.E.

ENGINEER OF RECORD: B.A.M.
DESIGN ENGINEER: D.S./E.A.
DRAWN BY: E.A.
CHECKER: D.S.
SCALE: NTS

ENGINEER OF RECORD: BRUCE A. MOWRY, PH.D., P.E. NO. 61302

NO. DATE REVISION APP'D. BY

F:\WORK\$ALL\11 EMPLOYEE FOLDERS\...\Pump Stations concept & configuration\Drawings

File Name: Pump Station Configuration1.dwg
Survey Reference:
Field Book: N/A Page: N/A Work Order: 75436
Date: 3/17/14 Sheet: 1 of 1 Drawing

Stormwater Vortex

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Vortex structure installed

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Vortex structure installed

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Finishing installing vortex structure

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Pump Station wet well

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Pump station discharge pipes

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Pump Stations

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Pump Stations

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Pump station discharge pipes

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Pump station pump foundation

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Finishing the bottom of the pump station

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Pump station wet well with lid

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Completed structure

Pump station outfalls

Pump Station outfall pipe

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City of Miami Beach – Sea Level Rise Adaptive Management

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1-meter sea level rise: Population: 87,933

- Adaptive response strategies and potential options
  - Protection
    - Shore armoring
    - Beach re-nourishment
    - Sea walls, inflatable barriers
  - Implement new policies governing new and renovated construction
    - Finished floor elevations and roadways raised above new base flood levels
      - Must address potential benefits and unintended consequences
  - Avoid/Retreat
    - Prohibit development, plus:
      - Transfer of development rights
      - Land acquisition
    - Post-disaster downsizing, plus
      - Transfer of development rights
      - Land acquisition
    - Rolling easements
  - Frequent review and evaluation of sea level rise trends

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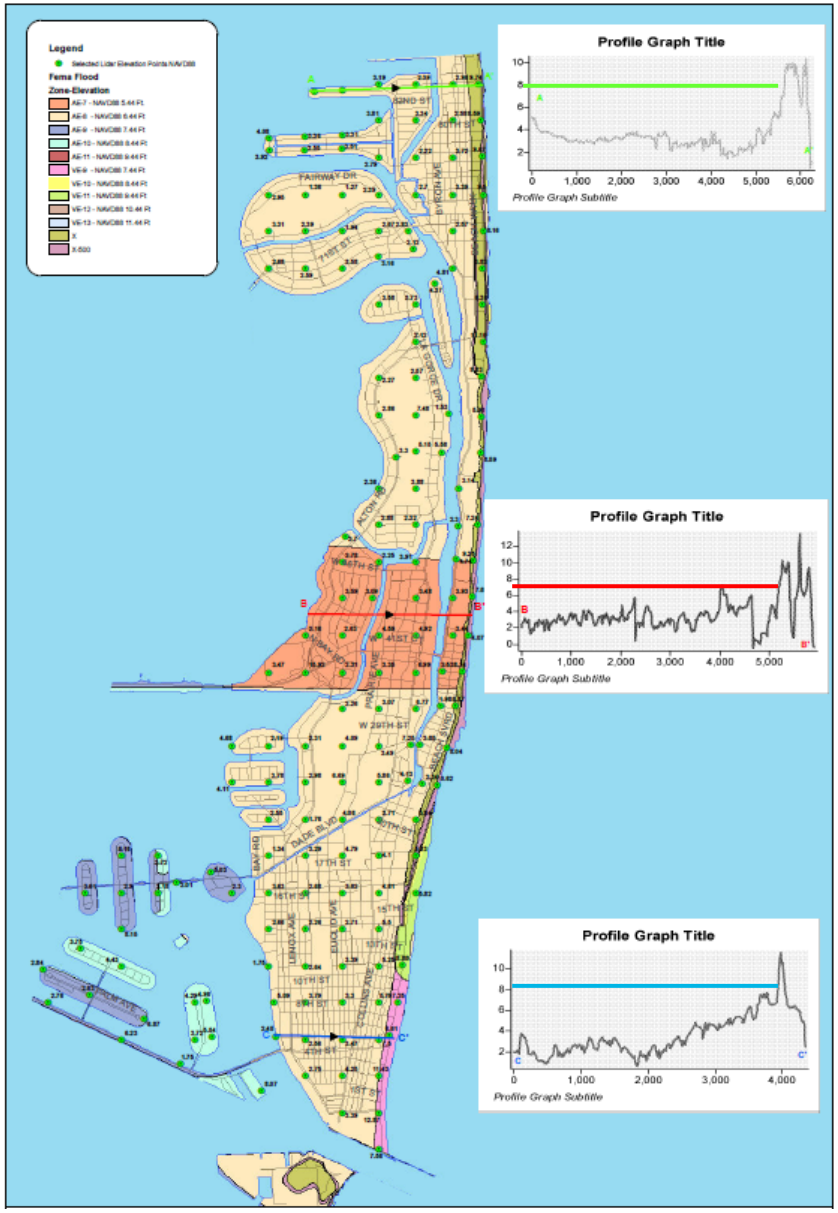
City of Miami Beach – Vulnerability and Adaptation of Eight Major Areas of Climate Change



- Fish & Wildlife Habitat Degradation
- Inadequate Water Supply
- Flooding
- Unchecked or Unmanaged Growth
- Groundwater Quality Degradation
- Education, Economy & Lack of Funds
- Fire, public services, sewage disposal, & transportation
- Availability of insurance:
  - It is projected that 26% of homes w/mortgages in the City will be flooded in the next 30 years
  - At what point will areas within the City become uninsurable?

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PUMPED OUT!
SCOTT ROBINS AS
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THE OCEAN AS
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COMING SOON
TO A STREET NEAR YOU


Costarring FlexValve Played by "One-Way"
Costarring Jimmy Morales as "The Manager"
Executive Producer Bruce Mowry
Directed by Eric Carpenter
Associate Producer Jay Fink
Special Effects Mike Alvarez

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What's Next?

Images from Hurricane Sandy

- In the early 1900's, the City of Galveston was hit by a severe Hurricane. Galveston was rebuilt including a 14-ft high barrier to deter storm surge AND was raised 14-ft.
- After a natural disaster, Miami Beach will have to rebuild. Would they rebuild at the same elevation, using the same building codes or will the City have a disaster plan approved and ready to go?
- Private property will have to be condemned and the City will have to rebuild city block by city block.
- Public infrastructure will have to be reconstructed

Questions?

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